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BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Implement the Commission's Procurement Incentive Framework and to Examine the Integration of Greenhouse Gas Emissions Standards into Procurement Policies	R.06-04-009

NOTICE OF EX PARTE COMMUNICATION

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April 9, 2007

BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking to Implement the Commission's Procurement Incentive Framework and to Examine the Integration of Greenhouse Gas Emissions Standards into Procurement Policies	R.06-04-009

NOTICE OF EX PARTE COMMUNICATION

Pursuant to Rule 8 of the Rules of Practice and Procedure of the California Public Utilities Commission (Commission), the Cogeneration Association of California[1] and the Energy Producers and Users Coalition[2] (jointly CAC/EPUC), submit this notice.

On April 4, 2007, Evelyn Kahl, counsel to CAC/EPUC, Simon Minett, consultant with Delta Energy and Environment, Debbie Chance with Chevron U.S.A., Inc., and David O'Brien with ExxonMobil, met with President Peevey, his advisor, Nancy Ryan and Karen Shea, advisor to Commissioner Simon. The meeting was held from approximately 3:00 to 3:30 PM at the Commission's office in San Francisco.

Mr. Minett presented materials regarding important policy considerations in integrating combined heat and power (CHP) technology into California greenhouse gas (GHG) regulations. He pointed out that CHP already contributes to GHG reductions in

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1 CAC represents the power generation, power marketing and cogeneration operation interests of the following entities: Coalinga Cogeneration Company, Mid-Set Cogeneration Company, Kern River Cogeneration Company, Sycamore Cogeneration Company, Sargent Canyon Cogeneration Company, Salinas River Cogeneration Company, Midway Sunset Cogeneration Company and Watson Cogeneration Company.

2 EPUC is an ad hoc group representing the electric end use and customer generation interests of the following companies: Aera Energy LLC, BP West Coast Products LLC, Chevron U.S.A. Inc., ConocoPhillips Company, ExxonMobil Power and Gas Services Inc., Shell Oil Products US, THUMS Long Beach Company, Occidental Elk Hills, Inc., and Valero Refining Company - California

California, but holds substantial potential for further reductions if supported by sound implementation of the state's policy supporting CHP. Mr. Minett reviewed key features of European Union policies affecting CHP and measures taken to encourage CHP development. Mr. Minett and Ms. Kahl stated that EPUC/CAC has no firm proposal at this point for the integration of CHP into the GHG regulatory framework, but would be pursuing further analysis based on EU experience. Mr. Minett urged the Commission to ensure, at a minimum, that GHG regulations fairly account for the efficiency benefits of CHP and do not discriminate against CHP in favor of bundled utility purchases.

Handouts were provided and are attached to this notice.

To request a copy of this notice, please contact:

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Dated: April 9, 2007

Respectfully submitted,

Evelyn Kahl

Evelyn Kahl

Counsel to
the Energy Producers and Users Coalition
and the Cogeneration Association of California

CHP in the California GHG Regime




Dr Simon Minett, Director
Delta Energy and Environment
on Behalf of
The Energy Producers and Users Coalition
The Cogeneration Association of California

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Delta Energy and Environment
Research, Analysis & Strategic Solutions

Introduction

- Delta is a European CHP consulting practice whose directors have been at the centre of the development of CHP policy and the EU ETS
- Delta is working in this proceeding on behalf of EPUC and CAC whose members are major energy users and producers of electricity
  - Represent approximately 3200 MW, or approximately at least 1/3rd of California CHP capacity, offering carbon reductions of ~ 7 MMt CO_2e annually today
  - Have the potential for material growth in CHP capacity at California refineries and related operations
- The goal of these efforts is the fair treatment of CHP in the California's GHG regulations

Delta

Executive Summary

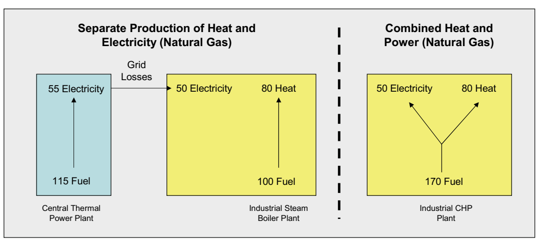
- CHP provides substantial opportunities for GHG reductions; EU identifies CHP as the single largest efficiency measure
- CHP technology carries an annual reduction value in California of ~30 million metric tons CO_2e by 2020
  - Retain existing benefits of ~22 MMtCO_2e for 9.2 GW
  - Realize ~9 MMtCO_2e for new installed capacity of 7.3 GW
  - New CHP represents ¼ of total CPUC CAT 2020 target
  - New CHP compares favourably with estimated 11 MMtCO_2e potential for increase in RPS target to 33%
- GHG Program Regulations must recognize the benefits and issues associated with CHP
  - Recognize full energy efficiency value of CHP
  - Avoid creating disincentives for CHP relative to utility electricity

Delta

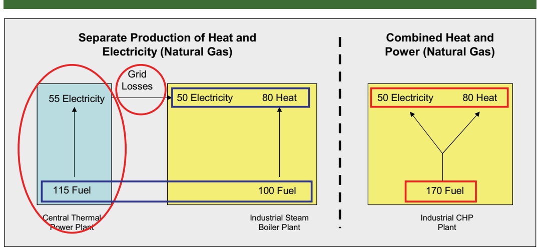
Benefits of CHP

Societal Benefits	Energy Benefits
• Improved and lower cost energy supply • Improved security of energy supply • CO2 savings through using CHP reduces pressure elsewhere	• Reduces fuel use • Integration of heat and power • Helps focus on end use efficiency
Environmental Benefits • CO2 savings • Reduced visual, dust, NOx and SOx emissions • Water savings	**Localisation of Power** • Reduces network strain • Improves efficiency • Improves security

CHP: More efficient…



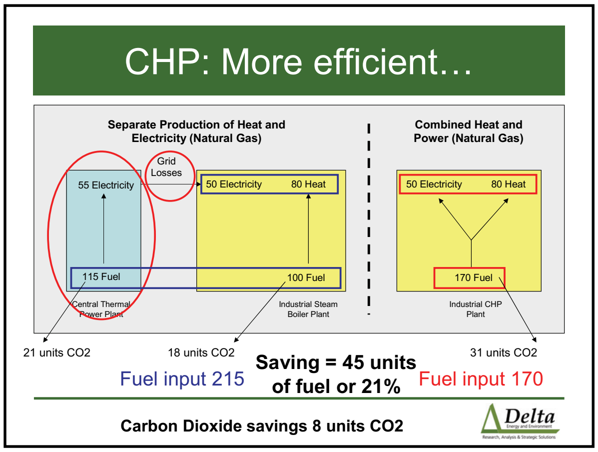
CHP: More efficient…

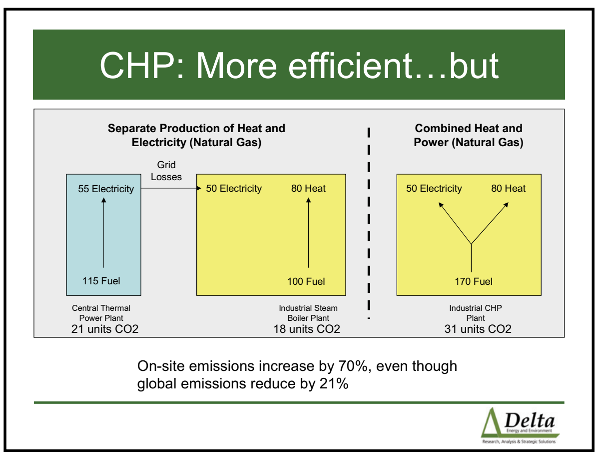


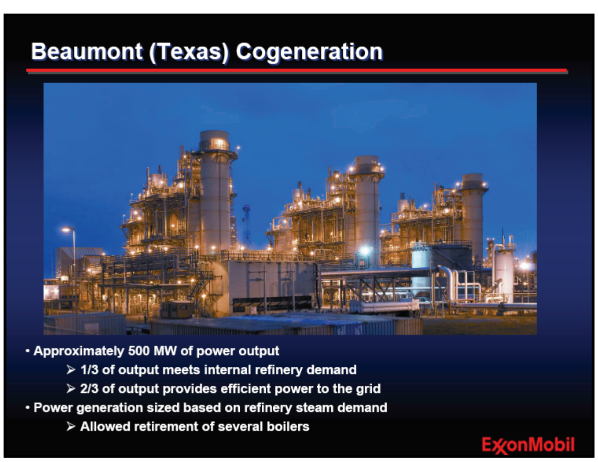
Fuel input 215

Saving = 45 units of fuel or 21%

Fuel input 170

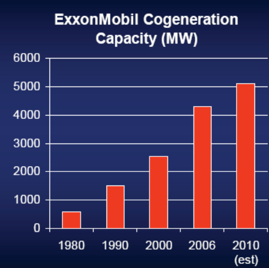

CHP: More efficient…
Separate Production of Heat and Electricity (Natural Gas)
Combined Heat and Power (Natural Gas)
Grid Losses
55 Electricity
50 Electricity
80 Heat
115 Fuel
100 Fuel
170 Fuel
Central Thermal Power Plant
Industrial Steam Boiler Plant
Industrial CHP Plant
21 units CO2
18 units CO2
31 units CO2
Fuel input 215
Saving = 45 units of fuel or 21%
Fuel input 170
Carbon Dioxide savings 8 units CO2
Delta


CHP: More efficient…but
Separate Production of Heat and Electricity (Natural Gas)
Combined Heat and Power (Natural Gas)
Grid Losses
55 Electricity
50 Electricity
80 Heat
115 Fuel
100 Fuel
170 Fuel
Central Thermal Power Plant
Industrial Steam Boiler Plant
Industrial CHP Plant
21 units CO2
18 units CO2
31 units CO2
On-site emissions increase by 70%, even though global emissions reduce by 21%
Delta


Beaumont (Texas) Cogeneration
• Approximately 500 MW of power output
➢ 1/3 of output meets internal refinery demand
➢ 2/3 of output provides efficient power to the grid
• Power generation sized based on refinery steam demand
➢ Allowed retirement of several boilers
ExxonMobil

ExxonMobil: A Leader in Cogeneration

- First installation in 1950's
- Over 4,300 MW installed with projects under development all around the world
- ExxonMobil self-generates well over 50% of its total electricity demand
- CO_2 emissions reduced >10.6 million metric tonnes per year
  - Equivalent to ~85% of wind capacity in USA
- Cogeneration provides high overall efficiencies, low costs per MWh & low CO_2 emissions. But ....
  - Higher total capital costs
  - Facilities must be base-loaded
  - Back-up power may be required



ExxonMobil

EU ETS and Other Policies

- EU has targets for CO_2, energy efficiency and competitiveness
- EU ETS scheme covers around 50% of emissions and the rest of emissions are covered by other policy and measures
- EU ETS is a market-based scheme that interfaces with other policies
  - Phase 1 2005-2007, learning by doing
  - Phase 2 2008-2012, real targets and commitments
  - Phase 3 post-2012, under discussion, long term and deeper cuts
- EU ETS does not include nuclear and renewable energy generation
- CHP Directive
  - Provides a legal basis for CHP in Europe

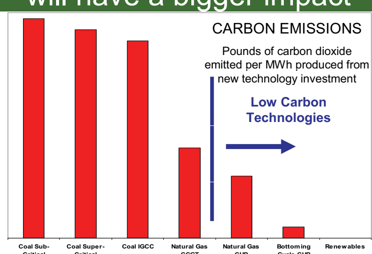
EU-ETS Phase II Incentive Examples – New Entrants

- Benchmarking: Germany based allocation on double benchmarking for power and thermal production.
  - Rewards the CHP plant for carbon savings against best alternative technologies (CCGT power and gas boiler)
  - 350 MWe CHP plant emits 1.32 $MMtCO_2$/year
  - Benchmark emissions are 1.02 $MMtCO_2$/year for electricity and 0.68 $MMtCO_2$/year for heat
  - Allocation to CHP plant is 1.70 $MMtCO_2$/year: a surplus of 0.38 $MMtCO_2$/year
- UK uses a CHP sector and provides full allowances on the capacity, but only with a load factor of 73% (normally a industrial CHP facility will operate at a load factor of 90% or more – this was a regulatory mistake)
  - resulting in the same CHP plant receiving 1.18 $MMtCO_2$/year
  - or a shortage of 0.14 $MMtCO_2$/year

CA Policy Considerations for CHP GHG Regulation

- CHP emissions fall in both the electricity sector (power production) and the industrial sector (thermal production)
- CHP GHG regulation must ensure that CHP is not penalized relative to industrial sites purchasing power from the utility
- Use of a single load-based portfolio benchmark in the electricity sector which includes nuclear and renewables will discourage operation of existing and development of new CHP
- CHP is one of the largest emission reduction measures in the power sector; any GHG program should ensure reasonable incentives for existing and new CHP

Focussing on low carbon technologies will have a bigger impact



GHG emissions policies should be supportive of "low carbon technologies"

– Includes renewables

– Also includes CHP and other 'low carbon' technologies

Note: For comparison purposes, CHP basis reflects reduced emissions from avoided fuel firing for process heat

Conclusions

- CHP is a proven technology available to achieve substantial reductions in GHG emissions in CA
- Further study is required to assure effective and fair integration of CHP in CA GHG program
  - Examine EU ETS implementation in the Member States of the EU: what works and what doesn't
  - Coordinate evaluation with CARB on the development of regulatory programs for industrial sector
- EPUC/CAC anticipate presenting a CHP proposal to the Commission over the next couple of months

Status:	Final
Confidentiality:	Open

Research, Analysis & Strategic Solutions

Date: **3 April 2007**

Report to EPUC and CAC

California GHG Reduction Program

THE ENERGY AND CARBON BENEFITS OF CHP

INTRODUCTION

The two coalitions of EPUC and CAC are preparing for the introduction of the Californian GHG Reduction Program. This paper, adapted from extensive modeling work done in Europe, looks at the benefits CHP (Combined Heat and Power) brings to the economy. The work does not look at economics, but considers both energy savings and carbon dioxide reductions. As in Europe, CHP presents a very compelling case for CO_2 reduction and thus any program designed to bring about CO_2 savings should, and must, deliver a growth in the use of CHP. In addition, existing CHP, provided that it is good quality, must be rewarded for early action and the fact that it has already delivered substantial carbon benefits during its operation.

CONCLUSIONS

The modeling has shown that CHP provides substantial energy and carbon reductions. When comparing with the avoided investment approach using the reference data from the EU CHP Directive for power plants and boilers. CHP saves in the range of 17-27% of primary energy input for the same outputs of heat and electricity. On-site CHP generation not only avoids less efficient electricity production from centralized power generation and heat-only boilers, but also minimizes grid losses and thus contributes to reducing the strain on electricity networks. The level of energy savings is dependent on the size of the plant, the level of voltage connection and the number of running hours per year. The carbon savings are related to the primary energy saving and are in the range of 0.25-0.37 million tons of carbon per 1000 MWe of CHP installed per year (0.90-1.35 $MMtCO_2$/year).

BASICS

CHP has long been recognized as a technique that reduced the energy consumption required to supply heat and power. Principally, most CHP plants produce electricity and heat, in the form of hot water or steam. However, CHP can also produce mechanical power, cooling through absorption chillers from the heat output and other heat outputs, such as thermal oil and the direct use of the exhaust gases. Attendant with the reductions of energy use come other benefits, such as reductions in emissions and especially carbon dioxide.

The degree of energy and carbon savings will depend on the technology and fuel used in the CHP project and on the alternatives displaced. The characteristics of a CHP project are well defined, so the main uncertainty in assessing carbon savings is in the fuel and efficiency assumed for alternative sources of the heat and power displaced. For practical purposes, certain conventions must be adopted to calculate carbon savings, particularly for portfolios of projects. The choice of convention, and the assumption to be made regarding fuel and efficiency for alternative sources, will be determined by the purpose and scope of the calculation and whether the savings are to be assessed now or into the future.

A CHP project is installed to meet a heat demand, either existing or new, that would otherwise be provided by boilers, along with an economic electricity supply. Existing boilers have well-known characteristics and it is relatively straightforward to calculate avoided emissions. Where the heat demand is new or the existing boiler has reached the end of its lifetime, it may be more appropriate to calculate the avoided emissions based on the characteristics of a new boiler. There are now very limited possibilities to improve the efficiency of new boilers.

THE MODELLING APPROACH

This study is based on a series of spreadsheets, which develop the analysis of the benefits of CHP. The spreadsheet model is not presented with this report, but is available to the CHPA and can be reviewed should this be necessary. The approach has been to make the whole analysis as open and transparent as possible. This will allow a more productive debate on the benefits accruing from CHP. The aim is to provide a realistic assessment of CHP and its alternatives.

For the analysis five CHP projects have been analyzed. These are:

- 1 kWe domestic CHP plant using a Stirling engine for a single-family house;
- 1 MWe gas engine CHP project in a public sector building, a hospital;
- 9.6 MWe gas turbine CHP project in the food industry;
- 41.6 MWe gas turbineCHP project in the chemicals industry;
- 350 MWe CHP project using a gas turbine, heat recovery steam generator and a steam turbine in oil refining.

These are designed to be representative of the range of CHP projects seen in California, except the 1 kWe project is still not commercially available and is currently designed for the European market. In each case actual data have been obtained from similar plants, which have then been adapted to present more generalized projects (see Annex 1).

All calculations in the study have been undertaken using the Gross Calorific Value (Higher Heating Value) of the fuel. This approach is consistent with the methods used in the USA, but is not consistent with European (except UK) conventions and the CHP Directive, which use Net Calorific Value (Lower Heating Value). Note this has no effect on carbon emissions or carbon savings, only on reported efficiencies.

CHP performance has been compared with reference power plants and boiler plants. Here two alternative approaches can be adopted:

- Avoided Investment Approach. This is a comparison with new investments in the electricity and heating. CHP investments are compared against the next power sector investment, a CCGT of 410 MWe block size. The CHP also displaces investment in new boilers for the same heat output as the CHP plants.
- Most Likely Displacement Approach. This comparison compares the CHP plants with the average fossil-fuel fired electricity production in the Californian electricity system and older and therefore less efficient boiler plants. (This is relevant as the nuclear and Hydro-Electric plants are not displaced by the operation of CHP plants.)

In this analysis to date only the first of these has been reported.

The key data are presented below:

- A CCGT power plant with a manufacturer rated efficiency of 52.5% (57.7% LHV), which is based on the Siemens SCC5-4000F. The efficiency of this power station is then adjusted downwards to take account of expected peak performance in operation, in house loads and degradation over time. For baseload operation the annual efficiency is 48.7%. If the CCGT is not run baseload then the efficiency is lower than baseload operation. This is because of the increased number of stops and starts, ramping from part-load to full-load and sub-optimal operation. Thus mid-merit CCGT operation has an efficiency of 46.2% (95% of the efficiency of baseload operation) and peak load operation is 43.8% (90% of the efficiency of baseload operation). Thus caution must be exercised when using equipment supplier data or unsubstantiated claims.
- The EU CHP Directive gives data for the performance of power plants and boiler plants. This was based on a very extensive evaluation looking at all available data sets in Europe, the US and elsewhere. These data have been used in this analysis.
- The delivered efficiency of electricity from the power plant to the site on which the CHP plants are located is adjusted to take account of grid losses. The average grid loss in the California was 8.5% in 2004. However, this does not give any indication of the real delivered efficiency. Data sets from the EU CHP Directive have been used (note the average grid loss in CA is very similar to the average in the EU). This approach estimates the losses that occur at different voltage levels in the electricity system, looking at both transformer losses and heating losses on the wires.
- Where a CHP plant only displaces imported electricity then the grid losses for that voltage level are incorporated in the delivered electricity efficiency. Where the CHP plants also export electricity to the network, then the exported electricity is assumed to displace the power station and the losses on the grid for the next voltage level up from the connection.
- Carbon emissions are based on the carbon content of the fuel and are based on UK Statistics and other European sources. It is unlikely that there is significant difference between US and European fuel sources. It is assumed that refinery gases have a carbon emission 15% less than natural gas. The carbon emissions from each source, be it power, heat or CHP, is a factor of the carbon content of the fuel and the efficiency of the cycle.

RESULTS

The results of the study are presented in the following tables. The discussion is kept short and only highlights the key points.

Technical specifications of the CHP plants:

Size	**1 kWe**	**1 MWe**	**10 MWe**	**50 MWe**	**350 MWe**
Sector	Domestic	Hospital	Food	Chemicals	Oil Refining
Heat Output	Hot Water	Hot Water	Steam	Steam	Steam
Heat to Power Ratio	6.67:1	1.24:1	1.56:1	1.18:1	1.07:1
Main Fuel	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Share of main fuel	100%	100%	100%	100%	75%
Secondary Fuel	None	none	none	None	Refinery Gases
Operational hours / year	3000	5500	7000	8200	8300
Electricity used on site	80%	100%	100%	75%	10%
Electricity Exported	20%	0%	0%	25%	90%

Summary of CHP Operation:

Size	**1 kWe**	**1 MWe**	**10 MWe**	**50 MWe**	**350 MWe**
Electrical Capacity (MWe)	0.0009	1.2	9.6	54.0	350
Heat Capacity (MWt)	0.006	1.4	15.0	63.8	375
Hours of operation (h/a)	3000	5500	7000	8200	8300
Electricity Production (MWh)	2.7	6353	62300	415740	2822000
Electricity Export (MWh)	0.5	0	0	103935	2539800
Heat Production (MWh)	18.0	7920	105000	522750	3112500
Fuel Consumption (MWh)	22.8	18210	230677	1314591	5985577
Efficiency of Use (HHV) (%)	90.7%	78.5%	74.6%	73.6%	75.4%
Carbon Emissions (tC/a)	1.14	909	11596	66081	360237
Carbon Dioxide Emissions (tCO2/a)	4.18	3333	42331	240666	1320867

Avoided Investment Approach:

Basis for Comparison

The EU CHP Directive methodology is that the CHP plant displaces the investment in a power plant and a new boiler plant using the same fuel as the CHP plant in the same year that the CHP came into operation. If more than one fuel is used in the CHP plant then a weighted average is used based on the energy content of the fuels.

Thus as all projects except the largest only use natural gas the power station displaced is a new investment in a CCGT. There is no adjustment for the duty cycle of the power plant. The displaced power station has an efficiency of 47.8% (HHV) at 15°C (59°F), which adjusted down by 0.1% point for every 1°C (1.8°F) above. California has an annual ambient temperature of around 20°C (68°F) and so the power station efficiency is adjusted down by 0.5% points. In the largest CHP plant, where 25% of the fuel is refinery gases, these displace an equivalent steam cycle power plant burning this fuel. This power plant has an efficiency of 40.2%, which is also adjusted by the same amount for temperature as earlier. Finally, the power is corrected for the grid losses. This is differentiated by the voltage connection level and whether the power is used on site or exported.

For the heat production, the CHP plant displaces a boiler. For hot water and steam, where the condensate is not recovered the efficiency on natural gas is 81.9% (HHV) and on refinery gas 81.0%. Where condensate is returned to the plant then these are adjusted down to 77.4% and 76.4% respectively.

Reference Data

Size	1 kWe	1 MWe	10 MWe	50 MWe	350 MWe
Power Plant Displaced	CCGT	CCGT	CCGT	CCGT	CCGT for 75%& Steam-cycle for 25%
Efficiency (HHV) (%)	47.3%	47.3%	47.3%	47.3%	45.4%
Grid Loss Factor of Imports	0.860	0.925	0.925	0.945	0.985
Imported Efficiency (%)	40.7%	43.8%	43.8%	44.7%	44.8%
Grid Loss Factor of Exports	0.925	0.945	0.945	0.965	1.000
Exported Efficiency (%)	43.8%	44.7%	44.7%	45.7%	45.4%
Boiler Efficiency (HHV) (%)	81.9%	81.9%	77.4%	77.4%	77.1%

Energy Savings

The energy savings calculations are based on the avoided electricity imported from the grid, displaced electricity for any export and the use of boiler plant for the heat provision. These are compared with the fuel consumed by the plant and the savings are then calculated. All data are for annual operation.

Size	1 kWe	1 MWe	10 MWe	50 MWe	350 MWe
Displaced Fuel for Imported Electricity (MWh)	5.3	14513	142332	697279	630611
Displaced Fuel for Exported Electricity (MWh)	1.2	0	0	227609	5590364
Displaced Boiler Fuel (MWh)	22.0	9670	135747	675824	4035893
Total Displaced Fuel (MWh)	28.5	24183	278078	1600712	10256867
CHP Fuel (MWh)	22.8	18210	230679	1315117	7481971
Savings (MWh)	5.7	5973	47309	285595	2774896
% Savings against References	20.0%	24.7%	17.0%	17.8%	27.1%
Savings per MWe installed per year (MWh)	6329	5973	4928	5289	7928

It can be seen that the energy savings from CHP range from 17% to 27%, and are in the range of 4930-7930 MWh per MW of installed capacity per year. These are substantial savings compared with other energy saving measures.

Carbon Savings

Size	1 kWe	1 MWe	10 MWe	50 MWe	350 MWe
Emission from CHP (tC/a)	1.14	909	11517	65636	360237
Emissions from Electricity (tC/a)	0.33	724	7104	46160	296783
Emissions from Boilers (tC/a)	1.10	483	6775	33730	192540
Carbon Savings (tC/a)	0.28	298	2361	14254	129086
% Saving against references	20.0%	24.7%	17.0%	17.8%	26.4%
Carbon Savings per MWe per year (tC/a)	316	257	246	264	369
Savings per 1000 MWe (MMtC)	0.32	0.26	0.25	0.26	0.37
Carbon Savings (lb/MWhe)	231	104	84	75	101

The carbon savings are between 0.25 million metric tons of carbon (0.90 $MMtCO_2$) and 0.37 MMtC (1.35 $MMtCO_2$) per 1000 MWe installed per year. The carbon savings are affected by the hours of operation of the various projects and this is dependent on the heat demand and the seasonal nature of space heating.

ANNEX 1: CHP DATA

INSTALLATION DATA FOR CHP PLANTS

SIZE CASE		1 kWe	1 MWe	10 MWe	50 M
Description of the CHP Installation					
CHP Description		Domestic CHP	Gas Engine CHP	Gas Turbine CHP	Gas Turb
Prime Mover Type		Stirling Engine	Gas Engine	Gas Turbine	Gas T
Heat Recovery Type		Heat Exchanger	Heat Exchanger	Unfired-WHB	Fired H
Additional Prime Mover		No	No	No	Steam T
Heat Provision Grade		Hot Water	Hot Water	10 bar Steam	7 bar &
Primary Fuel		Natural Gas	Natural Gas	Natural Gas	Natura
Secondary Fuel		None	None	Gas Oil	Gas
Gas supply pressure		Atmosphere	Atmosphere	Atmosphere	Medium I
Compression of Fuel		No	No	Yes	Ye
Connection Voltage		230 V	440 V	6.6 kV	11
Location and use					
Top Sector		Residential	Public	Industry	Indu
Branch		Family House	Hospital	Food	Chem
Technical characteristics of the CHP Installation					
Electrical output capacity	MW	0.001	1.2	9.6	
Gas Compression and in-house loads	MW	0.000	0.0	0.7	
Net Electrical Output	MW	0.001	1.2	8.9	
Thermal output capacity	Tonnes				
Thermal output capacity	MW	0.006	1.4	15.0	
Electrical efficiency (LHV)	%	13.0%	38.5%	32.0%	
Thermal efficiency (LHV)	%	86.7%	47.8%	50.0%	
Total efficiency (LHV)	%	99.7%	86.3%	82.0%	
Electrical efficiency (HHV)	%	11.8%	35.0%	29.1%	
Thermal efficiency (HHV)	%	78.9%	43.5%	45.5%	
Total efficiency (HHV)	%	90.7%	78.5%	74.6%	
Power to heat ratio		0.15	0.81	0.64	
Heat to power ratio		6.67	1.24	1.56	
Fuel Consumption per hour	MW	0.0076	3.31	32.97	
Share of Primary Fuel	%	100%	100%	100%	
Primary Fuel Consumption	MW	0.0076	3.31	32.97	
Share of Secondary Fuel	%	0%	0%	0%	
Secondary Fuel Consumption	MW	0.0000	0	0.00	

INSTALLATION DATA FOR CHP PLANTS

SIZE CASE		1 kWe	1 MWe	10 MWe
Description of the CHP Installation				
CHP Description		Domestic CHP	Gas Engine CHP	Gas Turbine CHP
Operational data				
Hours of operation per year	hr/yr	3000	5500	7000
Full-load load factor	%	34.25%	62.79%	79.91%
Electricity on-site consumption	%	80%	100%	100%
Electricity Production	MWh	2.700	6353	62300
Heat Production	MWh	18.000	7920	105000
Primary Fuel Consumption	MWh	22.823	18210	230769
Secondary Fuel Consumption	MWh	0.000	0	0
Total Fuel Consumption	MWh	22.823	18210	230769
Electricity Used on-site	MWh	2.160	6353	62300
Electricity Exported	MWh	0.540	0	0
Carbon Emissions				
Primary Fuel	tC	1.14	908.86	11517.48
Secondary Fuel	tC	0.00	0.00	0.00
Total	tC	1.14	908.86	11517.48
CO2 Total	tCO2	4.18	3332.50	42230.77

Key: Cells in these tables that are colored light blue are input data and cells colored yellow are calculations.

The data have been supplied by various CHP operators in the CHPA and thanks are given to them, though the name are not released to protect commercial interests. (The full-load load factor is the MWh of power generated divided b capacity times the hours in the year.)

Note that in the model the data are in metric units, these have been converted for the report to commonly used US

COMMISSION DECISION

of 21 December 2006

establishing harmonised efficiency reference values for separate production of electricity and heat in application of Directive 2004/8/EC of the European Parliament and of the Council

(notified under document number C(2006) 6817)

(Text with EEA relevance)

(2007/74/EC)

THE COMMISSION OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Community,

Having regard to Directive 2004/8/EC of the European Parliament and of the Council on the promotion of cogeneration based on a useful heat demand in the internal energy market and amending Directive 92/42/EC ([1]), and in particular Article 4(1) thereof,

Whereas:

(1) Pursuant to Article 4 of Directive 2004/8/EC the Commission is to establish harmonised efficiency reference values for separate production of electricity and heat consisting of a matrix of values differentiated by relevant factors, including year of construction and types of fuel.

(2) The Commission has completed a well-documented analysis in accordance with Article 4(1) of Directive 2004/8/EC. Developments in the best available and economically justifiable technology which were observed during the period covered by this analysis indicate that for the harmonised efficiency reference values for separate production of electricity, a distinction should be drawn relating to the year of construction of a cogeneration unit. Furthermore, correction factors relating to the climatic situation should be applied to these reference values because the thermodynamics of generating electricity from fuel depend on the ambient temperature. In addition correction factors for avoided grid losses should be applied to these reference values to take account of the energy savings obtained when grid use is limited due to decentralised production.

(3) By contrast, the analysis showed that concerning the harmonised efficiency reference values for separate production of heat a distinction relating to the year of construction was not necessary as the net energy efficiency of boilers has hardly improved in the period covered by the analysis. No correction factors relating to the climatic situation were required because the thermodynamics of generating heat from fuel do not depend on the ambient temperature. In addition correction factors for heat grid losses are not required as heat is always used near the site of production.

(4) The harmonised efficiency reference values have been based on the principles mentioned in Annex III (f) of Directive 2004/8/EC.

(5) Stable conditions for investment in cogeneration and continued investor confidence are needed. In this perspective it is appropriate to maintain the same reference values for a cogeneration unit for a reasonably long period of ten years. However, taking into consideration the main aim of Directive 2004/8/EC to promote cogeneration in order to save primary energy, an incentive for retrofitting older cogeneration units should be given in order to improve their energy efficiency. For these reasons the efficiency reference values for electricity applicable to a cogeneration unit should become stricter from the eleventh year after the year of its construction.

(6) The measures provided for in this Decision are in accordance with the opinion of the Cogeneration Committee,

HAS ADOPTED THIS DECISION:

Article 1

Establishment of the harmonised efficiency reference values

The harmonised efficiency reference values for separate production of electricity and heat shall be as set out in Annex I and Annex II respectively.

Article 2

Correction factors for the harmonised efficiency reference values for separate production of electricity

1. Member States shall apply the correction factors set out in Annex III(a) in order to adapt the harmonised efficiency reference values set out in Annex I to the average climatic situation in each Member State.

The correction factors for the average climatic situation shall not

([1]) OJ L 52, 21.2.2004, p. 50.

If on the territory of a Member State official meteorological data show differences in the annual ambient temperature of 5 °C or more, that Member State may, subject to notification to the Commission, use several climate zones for the purpose of the first subparagraph using the method set out in Annex III(b).

2. Member States shall apply the correction factors set out in Annex IV in order to adapt the harmonised efficiency reference values set out in Annex I to avoided grid losses.

The correction factors for avoided grid losses shall not apply to wood fuels and biogas.

3. Where Member States apply both the correction factors set out in Annex III(a) and those set out in Annex IV, they shall apply Annex III(a) before applying Annex IV.

Article 3

Application of the harmonised efficiency reference values

1. Member States shall apply the harmonised efficiency reference values set out in Annex I relating to the year of construction of a cogeneration unit. These harmonised efficiency reference values shall apply for 10 years from the year of construction of a cogeneration unit.

2. From the eleventh year following the year of construction of a cogeneration unit, Member States shall apply the harmonised efficiency reference values which by virtue of paragraph 1 apply to a cogeneration unit of 10 years of age. These harmonised efficiency reference values shall apply for one year.

3. For the purpose of this Article the year of construction of a cogeneration unit shall mean the calendar year of the first electricity production.

Article 4

Retrofitting of a cogeneration unit

If an existing cogeneration unit is retrofitted and the investment cost for the retrofitting exceeds 50 % of the investment cost for a new comparable cogeneration unit, the calendar year of first electricity production of the retrofitted cogeneration unit shall be considered as its year of construction for the purpose of Article 3.

Article 5

Fuel mix

If the cogeneration unit is operated with a fuel mix the harmonised efficiency reference values for separate production shall be applied proportionally to the weighted mean of the energy input of the various fuels.

Article 6

Addressees

This Decision is addressed to the Member States.

Done at Brussels, 21 December 2006.

For the Commission

Andris PIEBALGS

Member of the Commission

ANNEX I

Harmonised efficiency reference values for separate production of electricity (referred to in Article 1)

In the table below the harmonised efficiency reference values for separate production of electricity are based on net calorific value and standard ISO conditions (15 °C ambient temperature, 1,013 bar, 60 % relative humidity).

%

	Year of construction: Type of fuel:	1996 and before	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006-2011
Solid	Hard coal/coke	39,7	40,5	41,2	41,8	42,3	42,7	43,1	43,5	43,8	44,0	44,2
	Lignite/lignite briquettes	37,3	38,1	38,8	39,4	39,9	40,3	40,7	41,1	41,4	41,6	41,8
	Peat/peat briquettes	36,5	36,9	37,2	37,5	37,8	38,1	38,4	38,6	38,8	38,9	39,0
	Wood fuels	25,0	26,3	27,5	28,5	29,6	30,4	31,1	31,7	32,2	32,6	33,0
	Agricultural biomass	20,0	21,0	21,6	22,1	22,6	23,1	23,5	24,0	24,4	24,7	25,0
	Biodegradable (municipal) waste	20,0	21,0	21,6	22,1	22,6	23,1	23,5	24,0	24,4	24,7	25,0
	Non-renewable (municipal and industrial) waste	20,0	21,0	21,6	22,1	22,6	23,1	23,5	24,0	24,4	24,7	25,0
	Oil shale	38,9	38,9	38,9	38,9	38,9	38,9	38,9	38,9	38,9	38,9	39,0
Liquid	Oil (gas oil + residual fuel oil), LPG	39,7	40,5	41,2	41,8	42,3	42,7	43,1	43,5	43,8	44,0	44,2
	Biofuels	39,7	40,5	41,2	41,8	42,3	42,7	43,1	43,5	43,8	44,0	44,2
	Biodegradable waste	20,0	21,0	21,6	22,1	22,6	23,1	23,5	24,0	24,4	24,7	25,0
	Non-renewable waste	20,0	21,0	21,6	22,1	22,6	23,1	23,5	24,0	24,4	24,7	25,0
Gaseous	Natural gas	50,0	50,4	50,8	51,1	51,4	51,7	51,9	52,1	52,3	52,4	52,5
	Refinery gas/hydrogen	39,7	40,5	41,2	41,8	42,3	42,7	43,1	43,5	43,8	44,0	44,2
	Biogas	36,7	37,5	38,3	39,0	39,6	40,1	40,6	41,0	41,4	41,7	42,0
	Coke oven gas, blast furnace gas, other waste gases, recovered waste heat	35	35	35	35	35	35	35	35	35	35	35

ANNEX II

Harmonised efficiency reference values for separate production of heat (referred to in Article 1)

In the table below the harmonised efficiency reference values for separate production of heat are based on net calorific value and standard ISO conditions (15 °C ambient temperature, 1,013 bar, 60 % relative humidity).

%

	Type of fuel:	Steam (*) /hot water	Direct use of exhaust gases (**)
Solid	Hard coal/coke	88	80
	Lignite/lignite briquettes	86	78
	Peat/peat briquettes	86	78
	Wood fuels	86	78
	Agricultural biomass	80	72
	Biodegradable (municipal) waste	80	72
	Non-renewable (municipal and industrial) waste	80	72
	Oil shale	86	78
Liquid	Oil (gas oil + residual fuel oil), LPG	89	81
	Biofuels	89	81
	Biodegradable waste	80	72
	Non-renewable waste	80	72
Gaseous	Natural gas	90	82
	Refinery gas/hydrogen	89	81
	Biogas	70	62
	Coke oven gas, blast furnace gas + other waste gases	80	72

(*) Il faut retrancher 5 points de pourcentage absolus au rendement vapeur lorsque les États membres qui appliquent l'article 12, paragraphe 2, de la directive 2004/8/CE prennent en compte le retour du condensat dans les calculs de rendement d'une unité de cogénération.
(**) Les valeurs applicables à la chaleur directe doivent être utilisées si la température est de 250 °C ou plus.

ANNEX III

Correction factors relating to the average climatic situation and method for establishing climate zones for the application of the harmonised efficiency reference values for separate production of electricity (referred to in Article 2(1))

(a) Correction factors relating to the average climatic situation

Ambient temperature correction is based on the difference between the annual average temperature in a Member State and standard ISO conditions (15 °C). The correction will be as follows:

0,1 %-point efficiency loss for every degree above 15 °C;

0,1 %-point efficiency gain for every degree under 15 °C.

Example:

When the average annual temperature in a Member State is 10 °C, the reference value of a cogeneration unit in that Member State has to be increased with 0,5 %-points.

(b) Method for establishing climate zones

The borders of each climate zone will be constituted by isotherms (in full degrees Celsius) of the annual average ambient temperature which differ at least 4 °C.The temperature difference between the average annual ambient temperatures applied in adjacent climate zones will be at least 4 °C.

Example:

In a Member State the average annual ambient temperature in place A is 12 °C and in place B it is 6 °C. The difference is more than 5 °C. The Member State has now the option to introduce two climate zones separated by the isotherm of 9 °C, thus constituting one climate zone between the isotherms of 9 °C and 13 °C with an average annual ambient temperature of 11 °C and another climate zone between the isotherms of 5 °C and 9 °C with an average annual ambient temperature of 7 °C.

ANNEX IV

Correction factors for avoided grid losses for the application of the harmonised efficiency reference values for separate production of electricity (referred to in Article 2(2))

Voltage:	For electricity exported to the grid	For electricity consumed on-site
> 200 kV	1	0,985
100-200 kV	0,985	0,965
50-100 kV	0,965	0,945
0,4-50 kV	0,945	0,925
< 0,4 kV	0,925	0,860

Example:

A 100 kW_{el} cogeneration unit with a reciprocating engine driven with natural gas generates electricity of 380 V. Of this electricity 85 % is used for own consumption and 15 % is fed into the grid. The plant was constructed in 1999. The annual ambient temperature is 15 °C (so no climatic correction is necessary).

According to Annex I of this Decision the harmonised efficiency reference value of 1999 for natural gas is 51,1 %. After the grid loss correction the resulting efficiency reference value for the separate production of electricity in this cogeneration unit would be (based on the weighted mean of the factors in this Annex):

Ref $E\eta$ = 51,1 % * (0,860 * 85 % + 0,925 * 15 %) = 44,4 %

COGEN EUROPE POSITION PAPER

Treatment of cogeneration in National Allocation Plans

15 May 2006

COGEN Europe urges Member States to adopt phase-1 best practices for the treatment of cogeneration in phase-2 in the EU Emission Trading Scheme

COGEN Europe urges Member States to harness the EU ETS for the promotion of energy efficiency by ensuring that cogeneration installations are allocated enough allowances to cover all of their emissions under the National Allocation Plans currently under preparation. Cogeneration, as the most efficient conversion technology, should not be submitted to reduced allocations of emission allowances.

High efficiency cogeneration is clearly identified as a “clean technology” in Commission guidelines COM(2003)830, while recital 20 of the ETS Directive (2003/87/EC) explicitly states that the “Directive will encourage the use of more energy-efficient technologies, including combined heat and power technologies.” Moreover, criterion 8 of Annex III to Directive 2003/87/EC[1] states that National Allocation Plans “shall contain information on the manner in which clean technology, including energy efficient technologies, are taken into account.”

For phase-2, which will be the first regular five year period (2008-12), **Member States should take the lessons from the experimental phase-1 trading period into account and design their NAPs according to the best practice examples set in phase-1 NAPs,** and described in the Annex on Best Practices.

Besides complying with the ETS Directive, National Allocation Plans offer Member States the opportunity to meet their commitments under the Directive on Energy end-use efficiency and energy services (2006/32/EC) and Directive 2004/8/EC on the promotion of cogeneration.

Directive 2006/32/EC requests that Member States submit to the European Commission a national Energy Efficiency Action Plan (EEAP) by 30 June 2007. The allocation methodologies embedded in the NAPs can form an integral part of the EEAPs. At the same time, phase-2 NAPs can be instrumental in bringing high efficiency cogeneration closer to the national potential, in accordance with the objectives set in Directive 2004/8/EC on the promotion of cogeneration.

COGEN Europe recognises that Member States have used and will continue to use different allocation methodologies. It is essential however that Member States make use of all policy tools at their disposal under the European Emission Trading Scheme to incentivise high efficiency cogeneration properly, thereby allowing for the wider deployment of this energy efficient technology. An Annex on Recommendations is

ANNEX ON BEST PRACTICES

Benchmarking

The “benchmarking approach” is the most common promotion tool for high efficiency cogeneration. The two reference values (tonnes of CO_2 emitted per GWh of electricity and TJ of heat) are multiplied with the output values (GWhe and TJ) in order to determine the allocation to the installation. Thus, efficient installations performing better than the benchmark receive enough allowances to cover their emissions, whereas inefficient installations are short of allowances and thereby incentivised to improve efficiencies. For phase-1, benchmarking systems promoting high efficiency cogeneration are to be found in Germany, the Netherlands and Poland.

Best practice example for using the benchmarking principle: Germany

In Germany, existing cogeneration plants can opt for an allocation based on a double benchmarking-method in NAP1. Under this system, the allocation of allowances is based on a comparison with BAT (“best available techniques”) for the separate generation of power and steam. Thus, the higher efficiency achieved through cogeneration is automatically rewarded. Depending on the fuel and the technology, the specific emission factor for the electricity generation benchmark ranges from 365 to 750 tCO_2 per GWhe. For steam, the emission factor ranges from 225 to 345 tCO_2 per GWh. In addition to this initial allocation, there is a bonus allocation for cogenerated electricity during the reference period of 27 tCO_2 per GWh. In effect, the bonus lowers the benchmark for cogeneration.

Creation of a cogeneration sector

In contrast to the benchmarking approach, the “sectoral approach” starts from the overall national allocation limit, breaks it down by industrial sectors, and then calculates the allocation at installation level as a final step. With each Member State free to determine the number and shape of the sectors, some countries have created a specific cogeneration sector and given it a preferential treatment to the separate heat and power production sectors. For phase-1, such a system was applied in Finland, Hungary and Poland. For phase-2, the United Kingdom is also aiming at creating a specific cogeneration sector.

Best practice example for establishing a cogeneration sector: Portugal

For NAP1, Portugal has chosen a top-down approach for allocating its allowances. The installations covered by the emissions trading scheme are divided into nine sectors, cogeneration being one of them. While there is no support mechanism for cogeneration in place at the installation level, the cogeneration sector as such is given special treatment as 25% of extra allowances are earmarked for the growth of the cogeneration sector during the first trading period. In the case of non-cogeneration power production a shortfall of 9% compared to the emissions of 2002 is foreseen. This approach takes the huge and currently underused potential for high efficiency cogeneration in Portugal into account.

Taking out the compliance factor

Taking out (or softening) the compliance factor is the second-most used mechanism for using the NAPs as a promotional tool for cogeneration. This mechanism can be employed when grandfathering has been chosen as the guiding principle and no distinct cogeneration sector has been created. The compliance factor, (also dubbed "potential of technologic improvement factor" or "progress factor"), which directly results from the intra-sector division of allowances and which is valid for the entire sector, can be taken out by applying the default value of 1 for cogeneration installations. This approach (with country-specific variations) is used for example in Austria, Belgium, France, Greece and Spain.

Best practice example for taking out the compliance factor: Greece

The Greek NAP1 foresees a favourable treatment for existing cogeneration plants and reads: "With respect to the emissions from combustion, it is considered vital to promote and support cogeneration." In Greece, the allocation of allowances follows the grandfathering principle, where every sector receives a specific growth factor and a compliance factor. While for non-cogeneration installations the compliance factor is set below 1 and then multiplied with the allocation basis (e.g. a reduction target of 8% leads to the compliance factor 0.92), the compliance factor is automatically set at 1 for cogeneration installations. Thus any sector specific reduction target is taken out. In the Greek NAP1, only cogeneration benefits from this mechanism, a testimony to the efficiency credentials of this technology.

Production-based premium

The production-based premium is the simplest mechanism for the promotion of high efficiency cogeneration. Per GWh of cogeneration production, an additional amount of allowances is allocated to the installation. This approach implies that one part of the allowances pool is earmarked for cogeneration at the beginning of the process of designing the allocation plan. The production-based premium can be introduced into both the benchmarking and grandfathering systems. Member States, which use a production-based premium include the Czech Republic and Germany.

Best practice example for a production-based premium: Czech Republic

In the Czech Republic, cogeneration plants receive a bonus of 430 allowances for every GWh of electricity produced. Assuming a price of €25 per allowance, this mechanism supports electricity from cogeneration (both electricity consumed on-site and exported to the networks) by around €cent 1.1 per kWh. The Czech NAP1 is the only one which allows for a direct quantification of support given to cogeneration. 1.5% of all allowances are earmarked towards this production-based cogeneration premium in phase-1. Should applications for the premium exceed the earmarked amount, the extra allocation will be equally cut back among the installations.

ANNEX ON RECOMMENDATIONS

The following sections offer policy recommendations for those Member States that wish to help develop their cogeneration markets in full compliance with Directive 2003/87/EC and Directive 2004/8/EC. Of the 15 phase-1 NAPs analysed, it was possible to distinguish between several generic approaches chosen by the Member States; the recommendations presented in this Annex has been divided accordingly.

NAPs that follow the benchmarking approach:

These NAPs inherently incentivise clean technologies and processes by using a reference value (e.g. tonnes of CO2 emitted per GWh), and can be regarded as being the "fairest" method of allocating allowances. In order to adapt these NAPs according to the best practice example, Member States should consider four principles:

(1) There should be no "cogeneration malus" in the allocation formula. The "malus" shields of separate production of electricity and heat from the competition of cogeneration plants by raising the benchmarks for cogeneration plants. Investment in cleaner technology becomes less attractive; the main purpose of the EU ETS is twisted to the opposite.

(2) The benchmarks should be differentiated between fuel inputs. Where this is not the case, investments will be directed towards fuels with the lowest carbon content per calorific value (natural gas) and only to a limited extend towards cleaner technologies and processes. Such practices contradict not only the purposes of Directive 2004/8/EC but also of the EU ETS, which aims at promoting cleaner technologies and not cleaner fuels.

(3) There should be a production premium for high efficiency cogeneration. Such a premium would – in full accordance with Directive 2004/8/EC – lower the benchmark for highly efficient cogeneration production, and give a clear incentive for the use of cleaner processes. It should be noted that "high efficiency cogeneration" is defined as providing primary energy savings of at least 10% compared to separate production of electricity and heat.

(4) The benchmarks should be based on best available techniques (BAT) under operational conditions and not on average emission levels. Only ambitious benchmarks give the clear signal to the private sector that the policy-makers ask for re-investments in cleaner ways of producing electricity and power. Benchmarks based on average emission levels are too lenient and will not achieve the desired results. An alternative is to use a mix between BAT and average emissions, with a floor for the cumulative benchmark (heat and power) no lower than 630kg per MWh of power output.

NAPs that include a specific cogeneration sector:

These NAPs reflect the fact that of all sectors covered by the EU ETS cogeneration holds a special potential of contributing to the reduction of greenhouse gas emissions. Member States that have chosen this path should consider two principles:

(1) When deciding the allocation of allowances between sectors, the growth potential for high efficiency cogeneration should be taken into account. Following Directive

2004/8/EC, Member States will during this year carry out studies on the national 2010, 2015 and 2020 potentials for high efficiency cogeneration. These results should be part of the basic considerations when deciding on the growth factor for the cogeneration sector.

(2) The definition of the cogeneration sector should be based on the definition given in the Directive 2004/8/EC. In order to be coherent with the Cogeneration Directive, no distinction between district heating and industrial cogeneration should be made. The only criteria for deciding whether to promote a certain installation should be the question whether the plant allows for high efficient generation.

<u>All other NAPs:</u>

NAPs that neither follow the benchmarking principle nor have established a specific cogeneration sector still allow for the promotion of cogeneration at the installation level. Several Member States have taken this route by taking out (or softening) the sector-specific compliance factors for cogeneration plants. Three principles should be considered:

(1) There should be no compliance factor for cogeneration installations (i.e. compliance factor of 1). By taking this factor out of the allocation formula, all NAPs that are based on the grandfathering principle can be fine-tuned so that investment decisions are directed towards cleaner technologies and processes.

(2) The mechanism described in paragraph (1) should be used exclusively for cogeneration and biomass-fuelled installations. According to the Community guidelines on State aid for environmental protection, only these technologies and processes meet the general conditions for authorising environmental aid. In this context, the definition of cogeneration installations should be in line with Directive 2004/8/EC.

(3) As an alternative to deleting the compliance factor for cogeneration installations, NAPs could include a production-based premium for high efficiency cogeneration electricity. This mechanism has the advantage of fully following the spirit of Directive 2004/8/EC.

In addition, it is important that the number of allowances should not be based on historical emissions per year but rather on historical emissions per power output during the baseline year. Consequently, this last factor should be multiplied with the forecasted power output during the allocation period in order to calculate the number of allowances. Given the variability of power output from cogeneration, this flexibility is necessary for achieving a fair allocation.

These policy recommendations represent a direct output of the study entitled "The Treatment of CHP Plants in the Phase-1 NAPs" that was carried out by COGEN Europe in December 2005.

CERTIFICATE OF SERVICE

I, Karen Terranova hereby certify that I have on this date caused the attached **Notice of Ex Parte Communication** in R.06-04-009 to be served to all known parties by either United States mail or electronic mail, to each party named in the official attached service list obtained from the Commission's website, attached hereto, and pursuant to the Commission's Rules of Practice and Procedure.

Dated April 9, 2007 at San Francisco, California.

Karen Terranova

Karen Terranova

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